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Wetlands Communities

Community Description

Wetland communities have a common characteristic - their soil, or other substrate, is periodically saturated with or covered by water. A wetland is defined in the *Wisconsin Statutes* as: "an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions" *(Section 23.32 (1))*.

Wetlands form where the shape of the land is conducive to retaining water, including: flat areas or depressions with limited outflow, where groundwater is present at the land surface, and in floodplains with water flow-through. Wetlands can sometimes form in unlikely places, such as on slopes, when the local climate produces continually wet conditions (Verry 1988).

Water quality, quantity, periodicity, and chemistry are the major determinants of ecological development in wetlands (Verry 1988). These characteristics of water are often related to bedrock geology and depth, topography and landscape position, soils, and climate. This variety of influencing factors leads to many different kinds of wetland communities. Several major categories include:

Emergent aquatic communities, sometimes also called marshes, found in shallow water at the edges of lakes and streams.

Wet meadows, including sedge meadows and wet prairies. These communities form on permanently saturated soils and are dominated by grasses or sedges.

Peatlands are characterized by the accumulation of organic matter which is produced and deposited more rapidly than it is decomposed, leading to peat formation. This process is more likely to occur in cold climates where decomposition is slow. Peatlands include two wetland types that are usually defined separately:

- Bogs form in closed basins or on slopes where the only water sources are precipitation and surface runoff, and they typically have low nutrient status. The peat is acidic, formed from decomposed *Sphagnum* and other vegetation. Bogs were once thought to be a successional stage between open lake and forest, in which the peat mat would build up and be colonized by shrubs and eventually trees. We now know that bogs can persist in nearly the same condition for thousands of years (Coastal Mgmt. 1995).
- Fens also form in basins and on slopes, but groundwater inflow is present in addition to water inputs from surface runoff and precipitation. Fens receive greater amounts of oxygen and nutrients because of groundwater contributions and are less acidic. Different types of fens develop under different nutrient

conditions. Calcareous fens occur where limestone bedrock contributes high levels of calcium bicarbonate to the groundwater. Fens support grasses, sedges, and a diversity of other herbaceous plants. Peats in fens are less acid than those in bogs and can even be calcareous (Curtis 1959, Verry and Boelter 1978).

Shrub swamps are wetlands dominated by shrubs. They may occur as a successional stage that follows herbaceous vegetation on sedge meadows, fens or alluvial floodplains.

Forested wetlands may be dominated by either conifers or hardwoods. They are often associated with alluvial soils in floodplains and with saturated soils in former lakebeds or other low-lying landscape features.

The spatial arrangement of wetlands is one factor that makes them an important habitat or habitat component for wildlife species. Wetlands form connections between aquatic and upland areas, and can be a linkage among upland communities. Wetlands are found within forests, savannas, barrens, and prairies. They provide water, food and shelter for wildlife and supply unique habitat conditions for many plants. Many bird and mammal species rely on wetlands, especially during migration and breeding. Within a wetland, the heterogeneity of microhabitats contributes to the development of specialists; for example, different moss species are sometimes restricted to zones on the sides of hummocks in a fen (Crum 1988).

Ecological functions in wetlands are somewhat different from those of uplands. Succession, for all but shallow inland wetlands, is either:

1) so slow that it is almost imperceptible, based on accumulation of organic material (except where catastrophic disturbance or human activities have caused rapid changes),or,

2) based on frequent scouring of streamside wetlands by flooding, so that community structure does not change and develop over time

Wetlands have high rates of productivity as compared with other types of ecosystems, allowing them to support an abundance of plant and animal life. Also, movement of nutrients, organic matter, and propagules (cuttings, seeds, spores, etc.) through the system can often take place in water. This mobility contributes to food web relationships that are unlike those of uplands: producers consumers and decomposers may be spatially separate (Darnell 1978).

The names of wetland community types reflect their diversity, including wet-mesic prairie, southern hardwood swamp, open bog, calcareous fen, northern sedge meadow, shrub-carr, emergent aquatic, and alder thicket, among others. Most of these community types were described by Curtis in 1959. Since then some revisions have been made and additional types described by the Wisconsin Natural Heritage Inventory (NHI). For detailed descriptions of all of these community types please see the Wetland Communities of Wisconsin chart at the end of this chapter.

Global/Regional Context

About half of the original 221 million acres of wetland in the conterminous US have been lost since Euro-American settlement (Feierabend 1992). In 1997, the remaining wetland area was approximately 105.5 million acres (National Wetlands Inventory 2001).

Wetlands continue to be lost in the conterminous US. Between 1986 and 1997 there was an estimated net loss of 644,000 acres. This represents an 80% reduction in the rate of loss as compared with the previous decade. Causes of wetland losses nationally were attributed to: urban development, agriculture, silviculture, and rural development (National Wetlands Inventory 2001). Most of the losses due to silviculture occurred in the southeastern US where ditching and partial drainage are used in the process of forest conversion (Tom Dahl, National Wetlands Inventory, personal comm.).

The National Resources Inventory (NRI 2001) has compiled wetlands information for the Midwest region including the states of Minnesota, Wisconsin, Michigan, Iowa, Missouri, Illinois, Indiana, and Ohio. They found that between 1992 and 1997 there was a net loss of approximately 25,800 acres in the region. The net loss estimate is based on gross losses of 74,200 acres, and gross gains of 48,400 acres through wetland restoration and replacement. Of gross loss estimates, 38,500 acres were attributed to agriculture, 21,300 acres to development, and 14,300 acres to silviculture. [NOTE wrong font size in following sentence] The NRI estimates in the silviculture category may include losses of forested wetland not related to forestry operations (Steve Brady, NRI, personal comm).At this time individual state breakdowns of NRI data are not available, so we do not know where in the region these activities are occurring.

Wisconsin's situation is similar to that of the nation as a whole; 46 percent of its approximately 10 million acres of wetland were lost between 1780 and 1980. These losses were primarily due to drainage for agriculture. About 5.3 million acres of wetland currently exist in Wisconsin, mostly concentrated in the northern part of the state.

The *Wisconsin Wetlands* map in this chapter shows the state's current wetlands distribution. The wetland data displayed in this map were taken from the WISCLAND Land Cover Data (2001). The land cover information was interpreted from satellite images.

Issues of Function, Structure, and Composition

Extent Wetlands cover about 16% of Wisconsin's surface area and are noted for their abundance of plant and animal life. Of Wisconsin's 370 species of birds, 39% live in or use wetlands. Wetlands are typically interspersed among other community types, affecting and affected by these neighboring communities.

Distribution Many wetlands are forested (wet forests and wet mesic forests, for example) and are part of the continuum of northern or southern forest ecosystems. Wetlands are also interspersed among the former prairie and oak savanna areas of

southern and east-central Wisconsin. In the Driftless Area of southwestern Wisconsin, which was not directly affected by glaciation, forested and non-forested wetlands exist primarily along streams and rivers or at spring seeps. Lakes do not occur there except where they have been created by dams. In northern Wisconsin, wetlands occur on vast areas of peat soils occupying former glacial lake beds; as potholes, bogs, and fens; along streams and rivers; on the borders of lakes; as forested swamps and bottomlands; and as coastal wetlands along Lake Michigan and Lake Superior. Some wetlands occur in large continuous patches, while others are isolated within upland communities.

Diversity Wetlands vary in their plant and animal composition, vegetative structure, and diversity of physical and chemical attributes. Northern bogs, for example, are generally acidic and support different plant and animal species, in fewer numbers, than the alkaline marshes, meadows, and fens of southern Wisconsin.

Function Wetlands are important for many species of plants and animals, especially for migratory waterfowl that use them to find food, resting places, and seasonal habitats (Stearns 1978). Wetlands also play an essential role in sustaining a productive fishery (Great Lakes Information Network 2001). Additional social values associated with wetlands include aesthetics, culture, recreation, education, and scientific study. Wetlands perform a number of functions that benefit both natural ecosystems and human society. They act as a buffer between upland areas and surface waters. They trap sediment and pollutants, remove nutrients, protect shorelines, slow the effects of floodwaters, and moderate the impacts of droughts. This often protects water quality. They also serve as both discharge and recharge areas for groundwater, and sequester carbon in the organic soils that form beneath them.

Concerns Wetlands continue to be filled for development, although the rate has slowed during the past decade to about 347 acres per year. This loss is at least partially offset by wetland creation elsewhere. Unauthorized wetland filling is believed to be occurring, but the rate is unknown (WDNR 2000).

In addition to the loss of wetlands to agriculture and development, activities that can degrade or alter wetland characteristics are of concern. Wetlands are typically interspersed among other community types so activities in uplands affect them. Changes in hydrology alter water chemistry and flow rates, and can lead to a turnover in vegetation. Residential and industrial development, and road, dam and utility construction often cause such hydrologic changes. At a larger scale, when a watershed contains more than about 60% open land or younger forest (less than 15 years of age), snowmelt occurs more rapidly and can increase streamflow rates by up to three times. The rapid snowmelt can lead to flooding, channel erosion and sedimentation, and downstream transport of materials (Verry 1992). Increasing development in many watersheds results in pollutants and sediments entering wetlands through runoff. Also, in urban and agricultural areas, groundwater is sometimes withdrawn to the point where water tables are lowered and wetlands are significantly impacted.

Non-native invasive species are modifying some wetlands to a large degree, although acreage inventories are not available. Species currently a problem in Wisconsin include purple loosestrife (*Lythrum salicaria*), Reed canary grass (*Phalaris arundinacea*), and common reed (*Phragmites australis*). Glossy buckthorn (*Rhamnus frangula*) can also be a problem, mostly in cedar and ash swamps in central and southern Wisconsin. Some emergent wetlands are also being overtaken by the non-native narrowleaf cattail (*Typha angustifolia*). Information on the management and control of these non-native species can be found on the DNR and Nature Conservancy websites. (See Data Sources section on a following page.)

During the Cutover, log slides, log drives, and other activities, damaged streambanks and their associated riparian areas. Some riparian wetlands may still be affected by these changes in stream morphology a century later.

Assessment of Current Condition

The Wisconsin Wetland Inventory indicates that the state has a total of 5,385,290 million acres of wetland. These figures are based on aerial photography flown for 18 counties in 1978-79, with 54 counties updated based on aerial photos taken between 1986 and 2001.

Inventory information shows that about half of the original wetland area of the state has been lost to land use changes, primarily agricultural drainage and road, urban and industrial development. Wetlands along rivers and lakes have been developed for port facilities, and for industries that required water for transport, cooling, or processing. Some communities have used wetlands as sites for waste discharge, marinas, wharfs, or residential developments. Deposition of dredge materials was also sometimes a factor in wetland loss or degradation.

The percentage of loss attributable to the different kinds of agriculture, urban, and industrial development is unknown. Many of the remaining wetlands have been observed to be in an altered or disturbed condition due to partial drainage, vegetation clearing, repeated burning, grazing, periodic plowing, and other agricultural uses.

Wetlands have also been degraded by hydrologic changes, erosion, sedimentation, and eutrophication. Poor water quality, brought about by agricultural, transportation, or urban land uses, can affect the floristic composition of wetlands and cause specialized species to be lost.

Wetland replacement projects sometimes result in a net loss of quality when the new wetland has less value than the former one. Underlying physical environmental conditions are difficult to replicate. Invasions by non-native species, and even some wetland enhancement projects, have been known to impair natural function and reduce important elements of biological diversity.

There is currently no assessment of Wisconsin's wetland conditions that describes the extent and importance of the different factors impacting wetlands. The DNR's Bureau of

Fisheries Management and Habitat Protection (WDNR 2000) has noted that the integrity of some wetlands is being affected by agricultural drainage, runoff pollution, alteration of water flows in the watershed, and loss of connections to quality upland habitat. Still, there are some wetlands relatively free of these disturbances. The Bureau of Fisheries Management and Habitat Protection is currently undertaking an assessment, and information on wetland condition for south central Wisconsin will be available in 2002.

Functional values of wetlands have been identified to standardize assessments of individual wetlands. Such functional assessments are conducted to evaluate the potential impacts of proposed activities that affect wetlands. These include requests for zoning changes, permits to fill or drain wetlands, or proposals to discharge treated effluent to wetlands. Functional values include floral diversity and occurrence of regionally scarce communities; fish and wildlife habitat; flood protection; water quality protection; shoreline protection; groundwater recharge and discharge; and aesthetic, recreational, educational and scientific values. Monitoring methods exist or are being developed to more fully evaluate the condition of wetlands, from broad-scale assessment to case-by-case analysis of wetland functions and quality.

Currently, 43% of all federally-listed threatened and endangered species use wetlands at some point in their life cycles (Feierabend 1992); for Wisconsin, 32% of the state's threatened and endangered plants and animals are wetland dependent (Charles Pils, DNR, pers. comm.). Further loss or degradation of wetlands would affect a disproportionate share of Wisconsin's rare species.

Socio-economic Conditions and Issues

Laws Wetland and aquatic communities are unique with respect to the local, state, and federal laws that govern their use. No other community types in Wisconsin have a comparable body of law to protect them. Federal laws that protect wetlands include the provisions of Sections 404 and 401 of the Clean Water Act and the 1985, 1990 and 1995 Farm Bills. In Wisconsin, Section 281.15 of the *Wisconsin Statutes* requires the Department to protect the waters of the state, including wetlands. Section 59.692, *Wis. Stats.* requires counties to adopt shoreland zoning ordinances for unincorporated areas within 1,000 feet of lakes and flowages and within 300 feet of navigable streams.

The Wisconsin Wetland Inventory (WDNR 1992, WDNR 2001), authorized by the Legislature in 1979, was first completed for all counties in 1984. The Inventory delineated and classified wetlands, originally using polygon sizes of 2 acres, 5 acres, or larger. It now delineates areas as small as possible based on 1:24,000-scale maps. Inventory maps are used primarily in planning for management or protection programs and activities. They are also used by counties for shoreland wetland zoning. Maps are only an initial step in determining wetland status. The legal status of an area is determined on a case-by-case basis using field observations.

The US Army Corps of Engineers (COE) and the DNR have jurisdiction over wetlands in the state. Persons wishing to conduct a project that will involve filling or dredging in

wetlands are required to contact the DNR water management specialist and the COE project manager for the county in which the proposed project is located. The water management specialist will determine whether a permit application is necessary. Permit applications are routed to both the DNR and COE, and they determine which agency has jurisdiction.

The DNR also has authority over other actions, in addition to filling or dredging, that may affect wetlands under their jurisdiction. These include DNR planning, management, funding, and other regulatory decisions.

Recreation Wetlands are also important for recreation, aesthetics, and education. They provide open spaces in landscapes that are becoming increasingly rare as development continues. Hunters and anglers use them for recreational pursuits. They can be used seasonally for canoeing, hiking, and cross-country skiing. Viewing and listening to wildlife are also popular wetland activities. The bird life in wetlands is often particularly easy to observe, making wetlands favorite bird-watching and photography areas.

Value Wetland functions have economic value in mitigating flooding, buffering shorelines, and protecting water quality by removing sediment and pollutants. New research continually demonstrates associations among wetlands, water quality, economically important fish and wildlife species, and the preservation of rare plant and animal species. Land-use plans recommend various levels of wetland preservation to maintain their values. Additional economic values arise from Wisconsin's major cranberry production industry in wetlands. Wild rice is produced on many lakes, and *Sphagnum* and other mosses are gathered for use in the floral industries. Recreation in wetlands also provides economic returns

Statewide Ecological Opportunities

In addition to protecting wetlands through regulations, the DNR and the US Fish and Wildlife Service have acquired wetlands for wildlife and fishery management, natural areas, and other public purposes in the state. These agencies, along with nonprofit conservation organizations, have acquired hundreds of thousands of acres of wetlands and have restored many thousands of acres of drained wetlands. Tribal protection and management of wetlands, such as the Bad River-Kakagon Sloughs and the Bayfield Peninsula's Raspberry Bay, is also significant due to the restoration of wild rice and control of exotic plant species.

Notable large wetland acquisition and restoration projects are: Horicon Marsh National Wildlife Refuge, the Glacial Lake Grantsburg Wildlife Area Complex, Necedah National Wildlife Refuge, Mead Wildlife Area near Wausau, Meadow Valley Wildlife Area near Necedah, Green Bay West Shores Wildlife Area, the Upper Mississippi National Wildlife Refuge, the Mink River Estuary in Door County, and the Lulu Lake-Mukwanago River project in Walworth County.

The wetland assessment in progress for south central Wisconsin will help identify locations where certain wetland types have become scarce or degraded. The information will be useful in prioritizing areas for restoration or protection.

There may be opportunities for identifying and protecting the rarest types of wetlands in the state, including the Patterned Peatlands, Inland Beach, Coastal Plain Marsh, and Calcareous Fen types through the State Natural Areas process.

In addition, there are opportunities to improve the functional values of degraded wetlands by restoring hydrologic functions. Adding culverts or re-routing roads and railroad beds out of wetlands, filling ditches, and breaking subsurface drainage tiles are examples of ways to partially restore hydrologic function.

Under the ecosystem management framework, ecological, social, and economic conditions are considered during planning and implementation of DNR activities. This includes the process of identifying wetlands for protection, acquisition, or restoration. Ideally, an alternative beneficial in each of these contexts would exist. In practice, some decisions will favor ecological concerns, while others will be based more heavily on social or economic factors.

Opportunities by Ecological Landscape

Table 1 indicates which Ecological Landscapes have occurrences of wetland types, and where they are more abundant. These data must be interpreted somewhat cautiously. The information is based on a 1999 data summary, and not all currently identified EL's and wetland community types are included. Inventories are not complete in all locations. Also, larger Ecological Landscapes would be expected to have more Element Occurrences (EO). Wetland communities are entered as an EO when they have high quality as evidenced by a relative lack of disturbance.

The table shows which EL's have occurrences of wetland types, and where they are more abundant. It can be used to identify areas where the best opportunities exist for protection, restoration, or acquisition of the various wetland types. When a highly ranked wetland type is present in one or a few EL's and scarce in others, such as the Shore Fen type, opportunities for protection become a higher priority. In EL's with more wetland occurrences, opportunities may exist for protecting or restoring larger patches that benefit certain wildlife and plant species. Economic and social issues often constrain management options in wetlands.

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Table 2. Wetland occurrences in Wisconsin's ecological landscapes.

Wetland type occurrences by Ecological Landscape	Northern Wet Forest (S4)	Tamarack Swamp (S3)	Northern Wet-Mesic Forest (S3S4)	Southern Wet Forest	Southern Wet-Mesic Forest	Alder Thicket (S4)	Shrub-Carr (S4)	Northern Sedge Meadow (S3)	Southern Sedge Meadow (S3)	Wet Prairie (SU)	Wet-Mesic Prairie (S2)	Open Bog (S4)	Bog Relict (S3)	Boreal Rich Fen (S2)	Poor Fen (S3)	Shore Fen (S2)	Calcareous Fen (S3)	Inland Beach (S3)	Emergent Aquatic (S4)	Emergent Aquatic - Wild Rice (S3)
Superior Coastal Plain	x	p	p			x	p	x				x			x	x		p	x	
Northwest Lowlands	x						p	p				p								
Northwest Sands	p	p	x			x	p	x				p			p	p			p	
North Central Forest	xx		xx			xx	x	xx				xx		p					xx	
Northern Highland	xx		x			x	p	xx				xx		p	x				x	p
Northeast Hills	xx		xx			x		xx				xx		p			p		x	
Northeast Sands	x		p			p	p	x				p							p	
Forest Transition	xx		p			p	p	x	p	p		x							x	
Northeast Plains	xx		xx			p	p	xx	p			x		p	p				x	
Northern Lake Michigan Coastal	x		xx	p		x	p	x			p	p		x					x	
Western Prairie						p		p											p	
Central Sand Plains	xx	x	x	p		xx	xx	xx	xx			x			xx	p	p		xx	
Western Coulees and Ridges	x		x	x	p	xx	xx	x	xx	p	p	p			p		p		xx	
Central Sand Hills	xx		p			x	xx	x	xx	p	xx	p				p	xx		xx	
Southwest Savanna							p			p	p						p		p	
Southeast Glacial Plains	xx		x	x	x	p	xx	x	xx	x	xx	xx	x				xx		xx	
Southern Lake Michigan Coastal			p		p		p		p	p	x						p		p	

xx= 15 or more EO's. x= 5-14 EO's. p= 4 or fewer EO's.

State Element Ranks assigned by the Wisconsin Natural Heritage Inventory are associated with the wetland types. Rankings are defined as follows (Wisconsin Natural Heritage Inventory Program 2001).

S1= Critically imperiled in Wisconsin because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2= Imperiled in Wisconsin because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3= Rare or uncommon in Wisconsin (21 to 100 occurrences).

S4= Apparently secure in Wisconsin, with many occurrences.

S5= Demonstrably secure in Wisconsin and essentially ineradicable under present conditions.

SU= Possibly in peril in the state, but their status is uncertain. More information is needed.

Data Sources
The following web pages have data and information about wetlands:

- National Wetlands Inventory. <http://www.nwi.fws.gov/> Information about the characteristics, extent, and status of the nation's wetlands and deepwater habitats. Electronic data on wetlands and a variety of map products are available.

- Wetland Science Institute. <http://www.pwrc.usgs.gov/WLI/> Details the efforts of a research institute that works to protect and restore wetlands. Includes project details, training information and technical notes.

- Environmental Protection Agency Office of Water. <http://www.epa.gov/OWOW/wetlands/index.html> Information on EPA programs, laws, regulations, assistance opportunities, and various wetland information and education resources.

- Wisconsin Wetlands, Wisconsin Department of Natural Resources. <http://www.dnr.state.wi.us/org/water/fhp/wetlands/> Information about wetlands and wetland regulations in Wisconsin. Click-on buttons take the user to the following topic areas:
  - Wisconsin Wetland Inventory, an inventory of Wisconsin's wetlands obtained from air photo interpretation and field verification of 1:24,000 scale black-and-white infared stereoscopic aerial photography. Map tiles correspond to townships, and can be ordered in paper or digital format from the website.
  - Wetland protection, linking to WDNR publications that describe programs and laws applicable to wetlands.
  - Permits, outlining the steps necessary for obtaining permits to dredge or fill a wetland.
  - Wetland functional values, describing values evaluated during wetland assessments.
  - Wetland restoration and management, linking to publications and other sites with information.

- Wetlands of Wisconsin - <http://www.wiscwetlands.org/wetlands.html> The contents of this website are from *Basic Guide to Wisconsin's Wetlands and Their Boundaries,* Chapter 3, compliments of the Wisconsin Coastal Management Program and Wisconsin Department of Natural Resources.

- Midwestern wetland flora: Field office guide to plant species. USDA Natural Resources Conservation Service, Midwest National Technical Center - <http://www.npwrc.usgs.gov/resource/othrdata/plntguid/plntguid.htm> Contains photos and brief descriptions of 300 species of Midwestern wetland plants.

- National Resources Inventory, USDA Natural Resources Conservation Service. <http://www.nhq.nrcs.usda.gov/NRI/1997/> The National Resources Inventory (NRI) is an inventory of land use and natural resource conditions and trends on US nonfederal lands. The inventory, most recently conducted in 1997, contains information on wetland gains and losses, and reasons for conversion.

- Great Lakes Information Network, E.P.A. <http://www.great-lakes.net/envt/air-land/wetlands.html> Provides an overview of wetlands in the Great Lakes region; a section on "What's New", and links to a variety of other resources pertaining to wetlands.

- Weeds on the Web, The Nature Conservancy. <http://tncweeds.ucdavis.edu/esadocs.html> This page includes links to all The Nature Conservancy's resources specific to individual invasive species. Element Stewardship Abstracts (ESA) is a complete report summarizing relevant aspects of an organism, including its ecology and control.

- Invasive Species website, Wisconsin Department of Natural Resources. <http://www.dnr.state.wi.us/org/land/er/invasive/index.htm> Links to lists of native and non-native plants, and non-native animals, along with references, DNR Technical Bulletins, links and related information.
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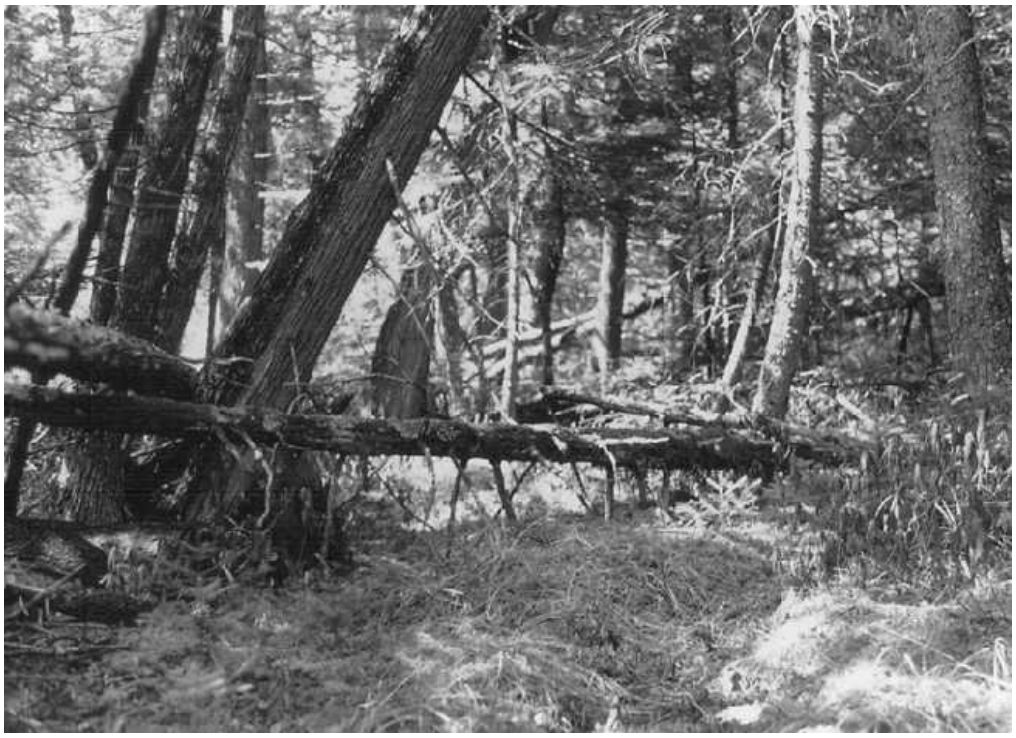
The Northern Sedge Meadow community type includes several kinds of open wetlands dominated by native sedges and grasses in northern Wisconsin. The meadow shown here developed on mud flats along a stream after a beaver dam had been abandoned and breached. It exhibits the characteristic tussocks created by the growth of tussock sedge (*Carex stricta*).

Wetlands provide a linkage between aquatic and upland habitats, as shown by the concentric bands of open bog, forested bog, and forested upland surrounding this lake in Vilas County.



The northern wet-mesic community type is dominated by northern white cedar (*Thuja occidentalis*). These cedar swamps provide habitat for important wildlife species and many rare plants. They often contain spring seepages, fallen tree tip-up mounds, and other important microhabitats.

Wild rice (*Zizania aquatica*) was once a widespread and abundant food plant growing in shallow water at the edges of lakes and rivers throughout Wisconsin. It has been lost from many areas because of log drives during the Cutover, dam construction, shoreline development, draining and filling in wetlands with shallow water, and changes in water quality.

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* Recommended reading

Wetland Communities of Wisconsin, from Curtis (1959), and Natural Heritage Inventory Program (NHI) (2001).

Community		Description	Approximate Original Area
Curtis (1959)	**NHI (2001)**		
Northern Lowland Forest		A group of community types that includes tamarack-black spruce bog forests, white cedar-balsam fir conifer swamps, and the black ash-yellow birch-hemlock swamps; found on lake bed depressions and along streams north of the Tension Zone.	2,240,000 acres in the two types.
Northern Wet Forest	Northern Wet Forest	Dominated by black spruce and tamarack; jack pine may be a significant associate. Understories are mostly *Sphagnum*, sedges, and ericaceous shrubs. Weakly minerotrophic. NHI redefined the Curtis type, and split out Black Spruce Swamp and Tamarack Swamp types.	Uncertain. Possibly 75% of total northern lowland forest or 1,680,000 acres.
	Tamarack Swamp	Tamarack Swamps typically occur on less acidic substrates and are floristically richer than Black Spruce Swamps. The influence of mineral-enriched groundwater is suggested by the presence of plants such as speckled alder, sedges, a variety of moss species, and sometimes skunk cabbage and marsh marigold where spring seeps occur. In southern Wisconsin, spruce is usually absent or of low importance. NHI further separates the community into northern and southern types: Tamarack (poor) Swamp and Tamarack (rich) Swamp.	Unknown.
	Black Spruce *Swamp*	Acidic conifer swamp dominated by a relatively closed-canopy black spruce overstory, and an open understory with Labrador-tea and *Sphagnum* moss species, but relatively few herbaceous plants. Similar to Open Bogs and Muskegs, but with canopy trees.	Unknown.
Northern Wet-Mesic Forest	Northern Wet-Mesic Forest	Dominated by white cedar, with associates balsam fir, black ash, and spruce, on rich, neutral to alkaline substrates. Ground flora contains orchids, wildflowers such as goldthread, fringed polygala, and naked miterwort, and a variety of sedges. Rare plants occur in cedar swamps more frequently than in most other habitats. NHI differs from Curtis, who described the Hardwood Swamp type together with Northern Wet-Mesic Forest.	Uncertain. Possibly 25% of total northern lowland forest or 560,000 acres.
	Hardwood Swamp	Northern deciduous forested wetlands occurring along lakes or streams, or in basins in poorly-drained moraines. Dominated by black ash, sometimes associated with red maple, yellow birch, and (formerly) American elm, and speckled alder. Herbaceous flora is often diverse, including marsh-marigold, swamp raspberry, skullcap, orange jewelweed, and a variety of sedges. Soils are mucks or mucky sands.	Unknown.
Southern Lowland Forest		A group of community types primarily found along river valleys and on lake plains, primarily south of the Tension Zone; also in depressions on poorly drained moraines. Types are known as bottomland or floodplain forests along rivers, and southern hardwood swamps on lake plains. Floodplain forests are present along all of the major rivers in southern Wisconsin; hardwood swamps are found around the larger existing lakes and also on extinct glacial lake beds. American elm was formerly important in all southern lowland forest types. Also occurs along major rivers north of the Tension Zone, but distribution is localized and many species drop out.	420,000 acres in the two types.
Southern Wet Forest		Dominated by black willow, cottonwood, silver maple, American elm (formerly) and river birch. Understory vegetation variable, depending on duration and timing of floods.	Very small, probably only 20% of total bottomland forest or 84,000 acres.

	Floodplain Forest	A NHI type that replaced part of Curtis' Southern Wet Forest and Southern Wet-Mesic Forest types. A lowland hardwood community occurring along large rivers; characterized by continuous water flow through the system and periodic flooding. Locally present in northern Wisconsin. Dominated by silver maple, river birch, green ash, hackberry, swamp white oak, and cottonwood. Nettles, sedges, ostrich ferns are common understory herbs. Lianas such as Virginia creeper and grapes are also common.	Unknown.
Southern Wet-Mesic Forest		Dominated by silver maple, American elm (formerly), green ash, swamp white oak, and hackberry. Corresponding NHI types are Southern Hardwood Swamp, and a part of Floodplain Forest. Typical understory herbs include green dragon, cardinal flower, toothwort, woods phlox, Virginia bluebells, and sedges.	Uncertain. Probably 80% of total bottomland or 336,000 acres.
	Southern Hardwood Swamp	A deciduous forested wetland that occurs in basins with seasonally high water tables but no continuous throughflow. Dominant trees are red maple, green ash, and formerly American elm. The invasive exotic Reed canary grass is often common in the understory, especially in stands disturbed by ditching or grazing. This NHI type was split from Curtis' Southern Wet-mesic Forest and Southern Wet Forest types.	Unknown.
	Forested Seep	Shaded seepage areas with active spring discharges, usually in hardwood forests and sometimes in cedar swamps. Common species vary, but may include black ash, yellow birch, American elm, hemlock, white pine, skunk cabbage, water-pennywort, and marsh blue violet. Some rare sedges are found in this type. Mostly in the Driftless area, or at the bare river bluffs.	Unknown.
Shrub Wetlands			
Alder Thicket	Alder Thicket	Common in spring-fed areas with mineral or muck soils along streams and around lakes, mostly north of the Tension Zone; dominated by speckled alder. Common herbs include Canada bluejoint grass (*Calamagrostis canadensis*), orange jewelweed, asters, boneset, marsh fern, and sensitive fern.	Unknown.
Shrub-Carr	Shrub-Carr	Common around lakes and ponds and invades sedge meadow, mostly south of the Tension Zone; this wetland community is dominated by tall shrubs other than tag alder, such as red osier dogwood and willow species. Canada bluejoint grass (*Calamagrostis canadensis*) is often common; other herbs are similar to those found in Alder Thickets and tussock-type Sedge Meadows.	Unknown.
Emergent Wetlands			
Sedge Meadow		Open wetland mostly dominated by sedges rather than grasses; found in all regions of the state in extinct lake beds, around the shores and banks of lakes and streams, and in depressions in pitted outwash or moraine topography. Sedge meadows occur on saturated peat or muck soils.	1,115,000 acres in the two types.
Northern Sedge Meadow	Northern Sedge Meadow	Several common subtypes occur. Tussock meadows, dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*) occur statewide but are generally smaller and less common in the north. Wire-leaved sedge meadows dominated by species such as woolly sedge (*Carex lasiocarpa*) and few-seeded sedge (*C. oligosperma*) are found mostly in northern Wisconsin and can cover hundreds, or rarely, thousands of acres. Broad-leaved sedge meadows are dominated by the robust sedges *C. lacustris* or *C. utriculata.* Frequent associates of all subtypes are marsh bluegrass (*Poa palustris*), Canada bluejoint grass (*Calamagrostis canadensis*), manna grasses (*Glyceria* spp.), panicled aster, joe-pye weed, and bulrushes.	Uncertain. Probably 105,000 or 115,000 acres.

Southern Sedge Meadow	Southern Sedge Meadow	Typically a tussock meadow, dominated by tussock sedge (*Carex stricta*) and Canada bluejoint grass (*Calamagrostis canadensis*); associates are water-horehound, marsh fern, marsh bellflower, panicled aster, blue flag iris, goldenrods, spotted joe-pye-weed, cattail, and swamp milkweed. Occurs along streams and lakeshores and in morainal depressions, widespread in southern Wisconsin. The invasive plant Reed canary grass (*Phalaris arundinacea*) may be dominant in disturbed areas.	Uncertain. Possibly 90% or 1,000,000 acres.
Wet Prairie	Wet Prairie	Grassland community on wet soils, south of the Tension Zone. Heterogenous tall grassland, including species characteristic of several types. Dominated by Canada bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), prairie muhly (*Muhlenbergia glomerata*), and several sedges. Other herb species often present include New England aster, swamp thistle, northern bedstraw, tall meadow-rue, golden alexander, and mountain-mint. May intergrade with sedge meadow or fen.	Uncertain. Possibly 5% of total prairie or 105,000 acres.
Wet-Mesic Prairie	Wet-Mesic Prairie	Tall grassland on seasonally wet soils; located south of the Tension Zone. Dominated by big *bluestem (Adropogon gerardii*), Canada bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), and wild rye *(Elymus canadensis*). Diverse forb component includes azure aster, shooting-star, prairie phlox, prairie coneflower, prairie docks, and goldenrods.	Uncertain. Possibly 20% of total prairie or 420,000 acres.
Open Bog	Open Bog	Has a thick, continuous carpet of *Sphagnum* with pronounced hummock-hollow micro-topography. Found in pitted outwash or kettle depressions, mostly in northern Wisconsin. Supports ericaceous shrubs such as leatherleaf, bog laurel, and small cranberry. Called 'Bog Relict' when found in southern Wisconsin.	No information. Probably less than 5% of conifer swamps or 110,000 acres.
	Muskeg	Cold, acidic, sparsely wooded northern peatlands. Vegetation similar to Open Bogs, but with scattered stunted black spruce and tamarack. Important for certain boreal bird and butterfly species that are not found in other communities.	Unknown.
	Bog relict	Boggy, acidic, weakly minerotrophic peatland community south of the Tension Zone; can include acidophiles such as *Sphagnum* mosses, sedges, ericaceous shrubs, and insectivorious herbs. Tamarack is the most common tree and poison-sumac is often abundant in the understory.	Unknown.
Boreal Fen	Boreal Rich Fen	This herbaceous peatland community is dominated by sedges, usually of the "wire-leaved" type. Mosses, if present, are not dominated by *Sphagnum* species. This community is diverse and capable of supporting rare, specialized species. Dominant/characteristic plants include woolly sedge (*Carex lasiocarpa*), Hudson's Bay cotton-*grass (Scirpus hudsonianus*), twig rush (*Cladium mariscoides*) and other rushes (*Juncus* spp.), sage willow, marsh timothy, and common bog arrow grass.	Unknown.
Poor Fen	Poor Fen (includes Central Poor Fen)	This herbaceous peatland type is similar in composition to the open bog but differs in its floristic composition, and has higher diversity, lower groundwater acidity, and less micro-topography. *Sphagnum* mosses are extensive in the poor fen, but not generally in thick blankets with pronounced hummock-hollow micro-topography. Besides the typical bog ericads and sedges, the flora may include many additional sedge species, bog goldenrod, rush aster, several orchids, and bladderworts.	Unknown.
	Patterned Peatland	A herb and shrub dominated peatland; a complex of small patches of both bog and fen types, rare in Wisconsin. Characterized by alternating peat ridges dominated by sedges and mosses (strings) and saturated and inundated hollows (flarks), oriented parallel to contours of a slope and perpendicular to groundwater flow. Flora may be very diverse, with sedge species characteristic of bogs and fens, ericads, sundews, orchids, arrow-grasses (*Triglochin* spp.), and calciphilic shrubs.	Very small.

	Shore Fen	These peatlands are restricted to Great Lakes shoreline areas, especially in association with estuarine river mouths along Lake Superior. Sand spits are almost always present. Lagoons on the inland side adjoin a floating mat of woolly sedge (*Carex lasiocarpa*). Bogbean, sweet gale, and twig rush (*Cladium mariscoides*) are important associates. They differ from other peatland communities in their lack of Sphagnum, and their direct hydrologic connection to the Great Lakes.	Unknown.
Calcareous Fen	Calcareous Fen	Shrub-herb community on wet and spring-fed sites with an internal flow of alkaline water, often underlain by calcareous marl. Common species include several kinds of sedges, marsh fern, shrubby cinquefoil, boneset, and asters, among others. Many rare herbaceous plants are associated with calcareous fens (e.g., small white lady's slipper, False asphodel, lesser fringed gentian). Found most frequently in southern Wisconsin where limestone bedrock or calcareous soils are near the surface.	Very small, probably only a few hundred acres.
	Coastal Plain Marsh	On sandy to peaty or mucky lakeshores, depressions, and ditches in and around the extinct glacial Lake Wisconsin. Harbors rare disjunct Atlantic Coastal Plain species. Common members of the plant community are sedges of the genera *Cyperus*, *Eleocharis*, *Fimbristylis*, *Hemicarpha*, *Rhynchospora*, and *Scirpus*; rushes (*Juncus* spp.); and a variety of flowering herbs.	Unknown; probably in the few hundreds of acres.
	Inland Beach	Beaches of sand or gravel that occur on the margins of lakes with naturally fluctuating water levels. They support a community that includes a specialized flora that may include Atlantic Coastal Plain disjuncts. Sedges and rushes are among the typical plants in this type. Vegetation may be characteristically zoned depending on water depth.	Unknown.
Great Lakes Beach	Great Lakes Beach	This beach community usually occurs in association with active dune systems and dynamic water levels. It includes specialized species such as the seaside spurge, and American sea-rocket.	Unknown.
	Interdunal Wetland	Wind-formed hollows that intersect the water table in active dune fields along Lake Michigan. Supports rare wetland plants. Common members of the community include twig-rush (*Cladium mariscoides*) and other rushes, pipewort, a sedge (*Carex viridula*), ladies-tress orchids, and bladderworts.	Very small; a few hundred acres at most, but probably less than 100 acres.
	Great Lakes Alkaline Rockshore	Creviced, wave-splashed, nearly horizontal dolomite ledges along Lake Michigan on the Door Peninsula. Dominant vegetation includes ninebark, shrubby cinquefoil, silverweed, goldenrods (especially *Solidago hispida*), and Indian paint-brush. Many rare plants of open calcareous habitats can occur in this type.	Unknown.
Emergent Aquatic	Emergent Aquatic	Group of wetland communities along the dividing line between true aquatic and true terrestrial communities, with permanent standing water. Includes deep and shallow marshes dominated by cattails, bulrushes, and reeds. Found along streams and in streamside marshes throughout Wisconsin and along lakes in glaciated parts of Wisconsin	Unknown.
	Emergent Aquatic – Wild Rice	Wild rice is a dominant species. Because of the biological and cultural interest in wild rice beds, NHI recognizes emergent marshes dominated by wild rice as a community type.	Unknown.